STAT231 Machine Learning and Pattern Recognition Fall 2014

Project 1

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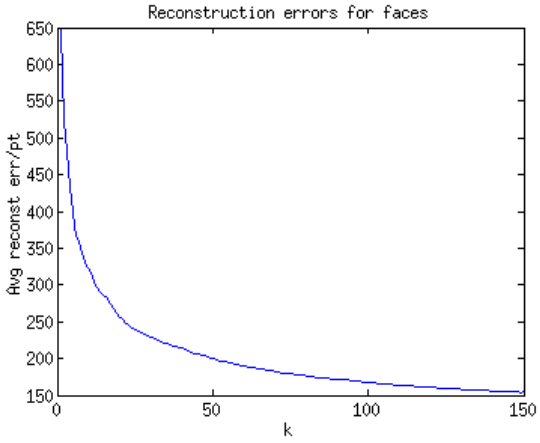
Part 1

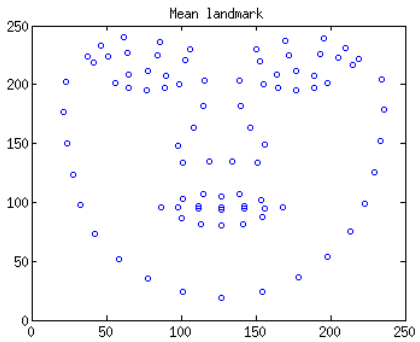
Below are the top 20 eigen-faces(From left to right, top to bottom):
Eigen-faces are computed by: $eig_{20}(faces - mean(faces)) + mean(faces)$

Below is the average reconstruction error for k from 1 to 150. Average reconstruction error is computed as $\frac{\sum ||original\,image - reconstructed\,image_k||^2}{256 \times 256 \times 27}$

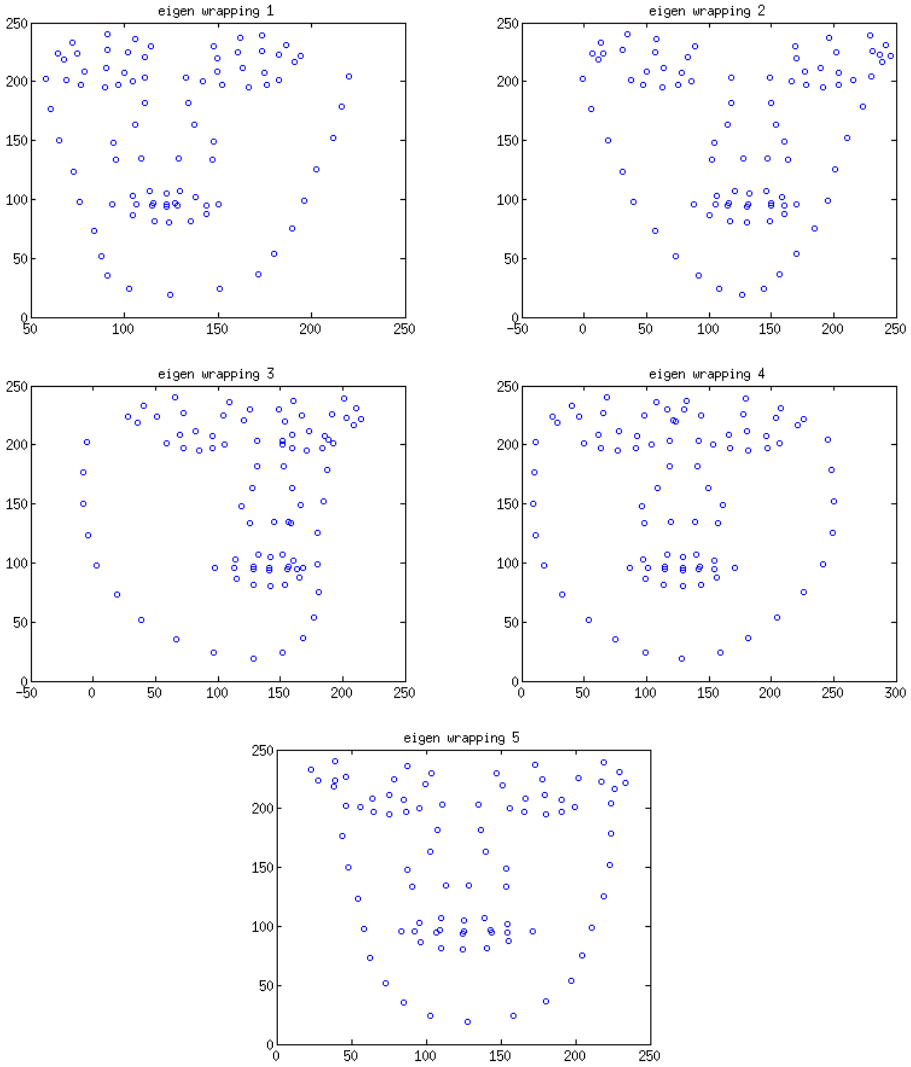


Below is the mean face:

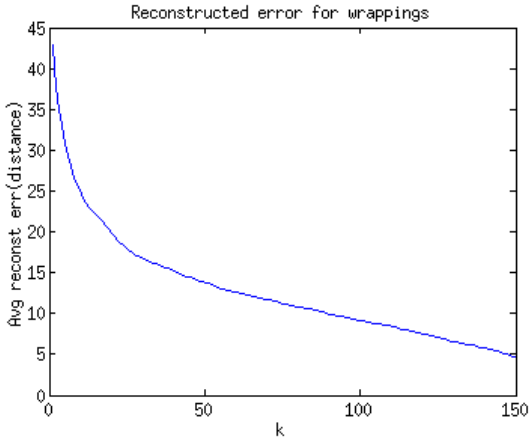
Part 2
Below is the mean wrapping:



Below are the top 5 eigen-warppings(From left to right, top to bottom):
Eigen-wrappings are computed by: $eig_5(landmarks - mean(landmarks)) + mean(landmarks)$



Below is the average reconstruction error for k from 1 to 150. Average reconstruction error is computed as $\frac{\sum ||original\,image - reconstructed\,image_k||}{27}$



Part 3

i:

Reconstructed landmark: project each test landmark to the top 10 eigen-warpings M of the training set.

ii:

Warped image: warp each test image from its own landmark to the training-mean position.

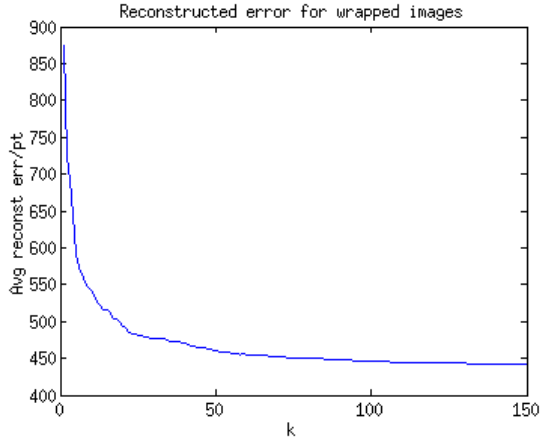
Reconstructed warped image: project the warped image to its top k eigen-faces V.

iii:

Final output: warp the reconstructed warped image from the mean position to the reconstructed landmark position.

iv:

Plot reconstruction error(same formula as in part 1):



Part 4

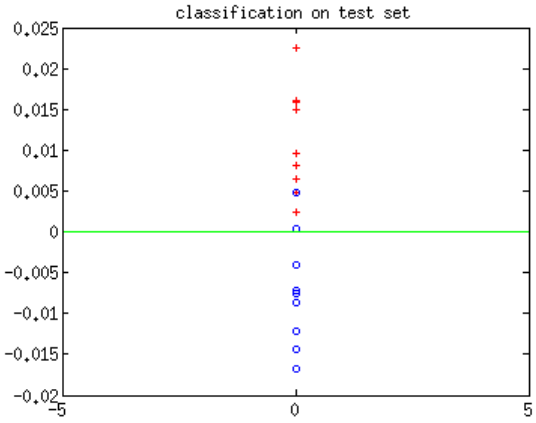
Sampled landmark ~ Gaussian(0, diag(eigen-values(reconstructed landmarks M in part 3)))

Sampled image ~ Gaussian(0, diag(eigen-value(reconstructed swarped iamges V in part 3)))

Synthesized image = warp(sampled image, mean landmark, sampled landmark)

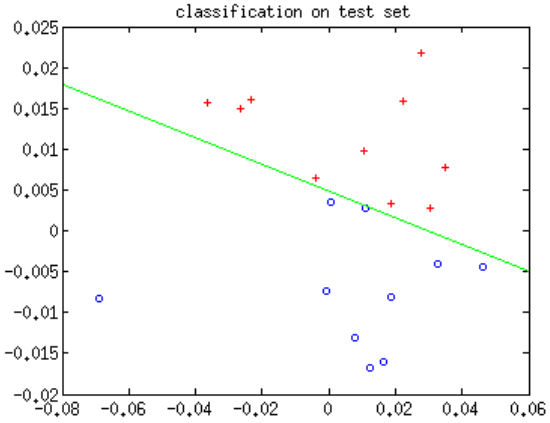
The 20 Synthesized images are shown below:

Part 5
Following the instruction, I got the plot as below:



+: Actual female
o: Actual male
Above the line: Predicted female
Below the line: Predicted male
Accuracy: 80%

Part 6
Following the instruction, I got the plot as below:



+: Actual female
o: Actual male
As we can see, the two classes are separated.
Above the line: Predicted female
Below the line: Predicted male
Accuracy: 100%